Thoughts on the Physics Nobel Prize 2020: Metaphysics - how astrophysicists gamble away their expertise

Mathias Hüfner 2022

Half of the 2020 Nobel Prize in Physics was awarded to Roger Penrose "*for discovering that black hole formation is a robust prediction of general relativity*" and half jointly to Reinhard Genzel and Andrea Ghez "f*or discovering a supermassive, compact object in the center of the Milky Way*".

If the layperson looks at the two images of galaxy M87 in Fig.1, he will see at first glance that they contradict the statements of the General Theory of Relativity. Neither matter nor light are captured by the galaxy. On the contrary, there is a powerful ejection of a plasma jet of luminous masses.

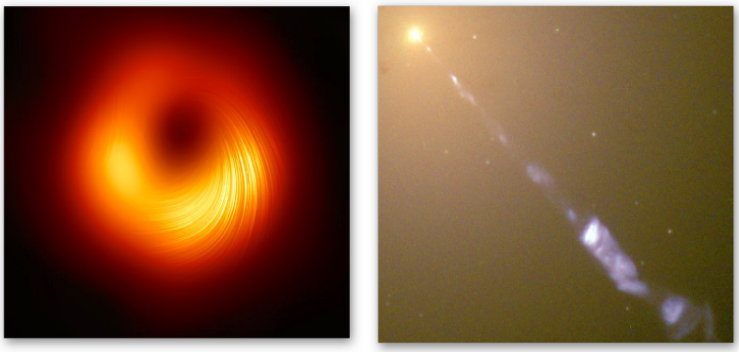


Fig. 1: Galaxy M87: left gas and aerosol vortices in the radio range; right with jet stream in visible light
Reference: EHT Kolaboration & ESO

So you have to rely on your own wits and do some research to interpret the picture at hand. A good two hundred and fifty years ago, with the beginning of the industrial revolution, the period of enlightenment also began in Germany and with it a spiritual liberation from the yoke of the church.

One of its most prominent representatives in the German-speaking world was Immanuel Kant. He postulated:
"Enlightenment is man's emergence from his self-inflicted immaturity. ... This immaturity is self-inflicted if its cause is not lack of understanding but lack of determination and courage to use it without the guidance of another." But reason alone is not enough. In addition, a high degree of factual knowledge is required, which in Kant disappears under the term experience. The conditions for acquiring factual knowledge were particularly favorable in Germany in the 19th century due to the small states and thus the high density of educational institutions. That changed with the emergence of the nation state of Germany and the unleashing of two world wars from German teritory. Between the two world wars, the church regained increasing influence on science, no longer by banning writings but by directly influencing leading scientists by recognizing them in their favor. So it becomes understandable that Kant had to be reinterpreted and his clear definition of metaphysics was distorted. The philosophy of positivism offered itself for this purpose. It was claimed that Kant's transcendental philosophy was scholastic and now relied entirely on sensory perception, disregarding observer-object relations. The core problem also went unnoticed. The treatment of the inductive conclusion. Karl Popper was the first to pick this up again in his research logic.

On the metaphysics of the black hole

According to Immanuel Kant, metaphysics is *"a completely isolated speculative cognition of reason, which rises entirely above the teaching of experience, namely through mere concepts, ..."* just like a black hole or other astrophysical concepts, which only serve to maintain the standard theory of astrophysics.

Fig. 2

Kant's *Critique Of Pure Reason* therefore aimed at saying that speculative reason should never venture beyond the limits of experience. He was aware that inductive reasoning can expand knowledge, but also that it needs to be limited by practical experience. In this context he spoke of the touchstone and if you leave out his subordinate clauses, he wrote in plain language: *"So it is not the expansion but the narrowing of the use of reason that leads to success in science, where, on the other hand, the expansion of inductive conclusions even supplants pure practical reason."* One has to take into account that he wrote the book under the conditions of an intellectual dictatorship. Despite a cryptic language, it was placed on the *"Index prohibitum librum"* by the Catholic Church. I want to use a simple example to show how up-to-date Kant's ideas are today.

Among the terms of astrophysics, the *"black hole"* as a gravitational monster that would capture even light is probably the best known metaphysical term, perhaps because of the argument between Leonard Susskind and Stephen Hawking over the preservation or destruction of information within a black hole, which went on for decades and was handed down to posterity by Susskind in the book "*The Black Hole War*" and only ended shortly before Hawking's death in January 2014 with Hawking's admission that there is no event horizon and therefore no black hole in the sense of the Theory. He recommended redefining the black hole in a 5 dimensional space. [1] So he stayed true at least to metaphysics.

Academic science uses a black hole to explain the speed plateau of spiral and ring galaxies (Fig. 4), from whose interior a plasma jet is observed coming.

Newton and the birth of gravity

Let us now turn to the phenomenon of gravitation as understood by Isaac Newton. For this we must go back to the beginnings of Greek philosophy. Aristotle assumed that bodies fall faster the heavier they are. And according to Aristotle, the sun, the moon and the planets, like the stars, are made of fire moving away from the center of the world, the earth. The scholastic Middle Ages clung to this idea.

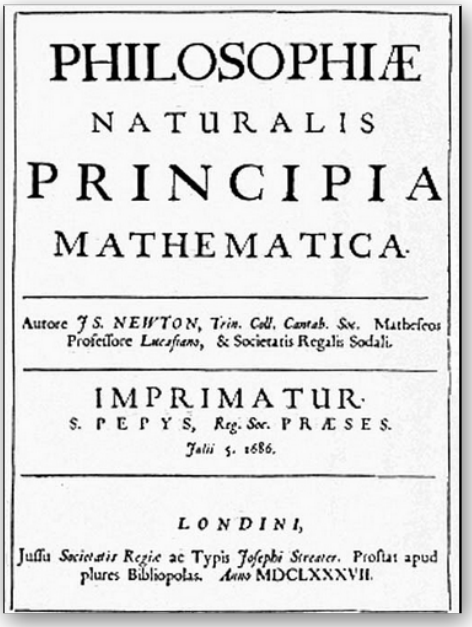
1 S. W. Hawking - *Information Preservation and Weather Forecasting for Black Holes ;* https://arxiv.org/abs/1401.5761

Giovanni Battista Benedetti (1530–1590) was the first to refute this Aristotelian assumption in his work *Demonstratio proportionum motuum localium contra Aristotilem et omnes philosophos* [2]) in 1554 in a simple thought experiment. Galileo Galilei initiated the change in physics by refuting the hypothesis put forward by Aristotle in 1647. During his experiments with a chute and a wooden ball and a lead ball, Galileo discovered that acceleration is something completely different from speed, and in 1638 he found that *„if you completely removed the resistance of the surrounding medium, all masses would fall at the same rate."*[3]) Johannes Kepler, relying on Tycho Brahe's exact observations of planetary motion, then succeeded in formulating his three Keplerian laws of planetary motion.

But it was not until Newton's *Philosophiae Naturalis Principia Mathematica*, published in 1687, in which he integrated Galileo's law of falling and Kepler's third law, that the foundation of classical mechanics was laid with the principle of inertia, replacing the Aristotelian assumptions. Newton's world is a world of forces and this is still true today. Forces are the reason of the dynamic element in the universe. For any change in the world a force is both responsible and necessary. This applies to the three academic disciplines, mechanics, thermodynamics and also electrodynamics. He postulated:

The following applies to all forces: force is mass times acceleration.

Applied to gravity, it too should be a force of this kind. The physical unit of force was named the newton in his honor. A newton is the force required to accelerate a body with a mass of 1 kg and an acceleration of 1 m/s^2.


PHILOSOPHIÆ
NATURALIS
PRINCIPIA
MATHEMATICA.

Autore J. S. NEWTON, Trin. Coll. Cantab. Soc. Matheseos Professore Lucasiano, & Societatis Regalis Sodali.

IMPRIMATUR.
S. PEPYS, Reg. Soc. PRÆSES.
Julii 5. 1686.

LONDINI,
Jussu Societatis Regiæ ac Typis Josephi Streater. Prostat apud plures Bibliopolas. Anno MDCLXXXVII.

Fig. 3

Forces are represented by vectors. A vector has magnitude and direction. Consequently, forces can only be distinguished according to their magnitude and their direction. There are three preferred directions in space that make up a main direction. However, in Newtonian mechanics, the force is understood one-dimensionally along the orbital radius. Here is a little anecdote:

> John Conduitt, Newton's assistant at the Royal Mint and husband of Newton's niece, was able to relate the following to the event when writing about the life of Newton:
>
> *„In 1666 Newton retired again from Cambridge... to his mother in Lincolnshire and while meditating in a garden it occurred to him that the force of gravity (which causes an apple to fall from a tree to the ground) was not acting on you certain distance to earth, but would have to reach much further than was always assumed. Why shouldn't it be so big that it reaches the moon,*

2 https://books.google.de/books/about/Demonstratio_proportionum_motuum_localiu.html?id=t8arMwEACAAJ&redir_esc=y

3 Armin Hermann: *Fallgesetze.* In: Armin Hermann (Hrsg.): *Lexikon Geschichte der Physik A–Z. Biographien und Sachwörter, Originalschriften und Sekundärliteratur.* 2. Aufl. Aulis Verlag Deubner, Köln 1978, S. 102.

he thought to himself and if so it should affect its motion and perhaps keep it in its orbit, after which he calculated what the effect of this interference would be... . "[4])

The moon revolves around the earth. Since its apparent size doesn't change, its distance stays about the same and therefore its orbit must resemble a circle. In order to move the moon on this circle, the earth must exert a pull on it, a force Newton called gravitation. The gravitational constant G appears in the modern formulation of Newton's law of gravitation. Newton himself formulated the law named after him mathematically differently and did not use the gravitational constant at all. It was only introduced much later.

He himself wrote, looking back on his discovery: *""In the same year (1666) I began to think about whether the force of gravity extends to the orbit of the moon. Having figured out how to estimate the force with which a sphere orbiting in a sphere presses on the sphere of the surface, I directed from Kepler's rule, according to which the periodic times of the planets are in a ratio of three to two to the distance from the center of their orbits, that the forces holding the planets in their orbits are the square of their distances from those centers around which they run, have to be reciprocal."*

In his calculation, the law looks like this:

$$F_{EM} = m_M \cdot \frac{4 \cdot \pi^2}{C_E} \cdot \frac{1}{r^2_{EM}} \qquad (1)$$

where F_{EM} is the gravitational pull between the earth and the moon, m_M is the mass of the moon, C_E is the Kepler constant for the earth, and r_{EM} is the distance between the earth and the moon.

Since the product of mass and Kepler's constant is the same for all bodies in the planetary system relative to the central body, the above formula can be rearranged somewhat:

$$F_{EM} = \frac{4 \cdot \pi^2}{C_E \cdot m_E} \cdot \frac{m_M \cdot m_E}{r^2_{EM}} = G \cdot \frac{m_M \cdot m_E}{r^2_{EM}} \qquad (2)$$

At Newton's time, however, the mass of the earth was still unknown, since the gravitational constant *G* had not yet been determined.

About 100 years after Newton, Henry Cavendish succeeded in measuring this constant G in 1798 with an apparatus that goes back to Charles Augustin de Coulomb and John Michell. [5]) Cavendish received a value of 6,754 $\times 10^{-11}$ $N \cdot m^2 \cdot kg^{-2}$. Using *G*, he was able to determine the mass of the earth for the first time and thus establish the connection between the gravitational constant and the acceleration due to gravity g (of 9.81 meters/second per second).

$$g = \frac{G \cdot m_E}{r^2} \qquad (3)$$

Coulomb was able to set up his law of surface charge using the same measurement principle for the electric force for the same dynamics with just a different amount of force. At the beginning of the 20th century, the academic boundaries between celestial mechanics and electrodynamics were defined and the restoration of metaphysics could gradually begin.

Now we know why Newton's apple falls to the earth and with what speed it can leave the earth, but the moon does not fall to the earth like the apple. He seems to be floating there without any forces due to gravity. This is a contradiction, because according to Newton's law, a body falling to earth

4 Keesing, R.G., The History of Newton's apple tree, Contemporary Physics, 39, 377-91, 1998

5 https://www.leifiphysik.de/mechanik/gravitationsgesetz-und-feld/geschichte/gravitationskonstante-historisch

would constantly accelerate, which should give it an unlimited rate of fall, which is not possible according to the principle of conservation of energy. We know from rocket launches that a space probe like the International Space Station receives a launch pulse so that it can orbit weightlessly on its orbit. But where did the moon get its momentum from and why the electrons do not fall into the atomic nucleus but remain in the atomic shell? Newton explains it this way at the end of the third book of his Principles:

> »*Tota rerum conditarum pro locis ac temporibus diversitas ab ideis et voluntate entis necessario existentis solum modo oriri potuit«* (Principia Lib. III. p. 675) Translation: *The whole universe, created from the variety of times and places, could only arise from the ideas and will of a necessarily existing being.*

Consequently, Newton assumes that the cause of gravitation and molecular long-distance effects is a "mental force" on whose strength and changes gravity and all molecular forces depend. In the imagination of this time, only a god can muster this power! Ultimately, the business model of the church is still based on this today, after Charles Darwin had already replaced the church's doctrine of creation with evolution. Albert Einstein still believed in this spiritual power when he separated gravitation from physical forces and connected it with non-Euclidean geometry, caused by a 'metaphysical' mental power.

However, if internal and external forces between masses can be measured with the torsion balance, they must inevitably have a cause, namely the elementary charges of the protons and electrons. Without knowing anything about protons, the Italian Fabrizio Mossotti[6] had already developed the idea in 1836 that gravitation is a residual force of the electric force and for every electric force there is a magnetic moment that generates a peripheral force called the Lorentz force. If a body is to be held on a circular path, two forces that are perpendicular to each other are required. With his law, Newton only described one direction of force between two distant bodies. However, masses are distributed three-dimensionally and so there are many forces acting on them.

In the first quarter of the 20th century, the realization matured that the sun, embedded in a spiral galaxy, rotates with its planets around the center of this galaxy. This led to the ether dispute between Albert Einstein and Dayton Miller, who in 1933[7]), using a Michelson interferometer from the anisotropy of the light on Mount Wilson, proved that the sun is moving together with the earth at 222 km/s in the direction of the south celestial pole. Einstein, fearing for his theory of relativity, dismissed Miller's results as temperature effects. Miller's achievement was simply erased from scientific memory and in all textbooks we read, that the speed of light would be constant.

Nowadays we know that the sun and its planetary system revolve around the center of the Milky Way in one galactic year, which corresponds to around 225 million Earth years. The earth therefore moves in relation to the galactic center together with the sun on a helical path in a plasma stream that induces a magnetic field around it.

However, the speed profile of the stars rotating around the center of a galaxy caused great astonishment among astrophysicists. According to an unbounded inductive conclusion about the validity of Newton's law of gravitation regarding galaxies, the velocity profile should look quite

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6 „*L'attraction universelle elle mê peut découler comme une déduction des principes qui règlent les forces électriques.*" aus F. Zöllner - Erklärung der universellen Gravitation aus den statischen Wirkungen der Elektrizität und die allgemeine Bedeutung des Weberschen Gesetzes Leipzig 1882 Commisionsverlag S. XXVI

7 Dayton Miller - *The Ether-Drift Experiment and the Determination of the Absolute Motion of the Earth.* Rev. Mod. Phys. 5, 203 – Published 1 July *1933*.

different (green curve in Fig.4). This led to the erroneous assumption that a gravitational monster must exist at the center of each galaxy and a halo of dark exotic matter around each galaxy to raise the green curve.

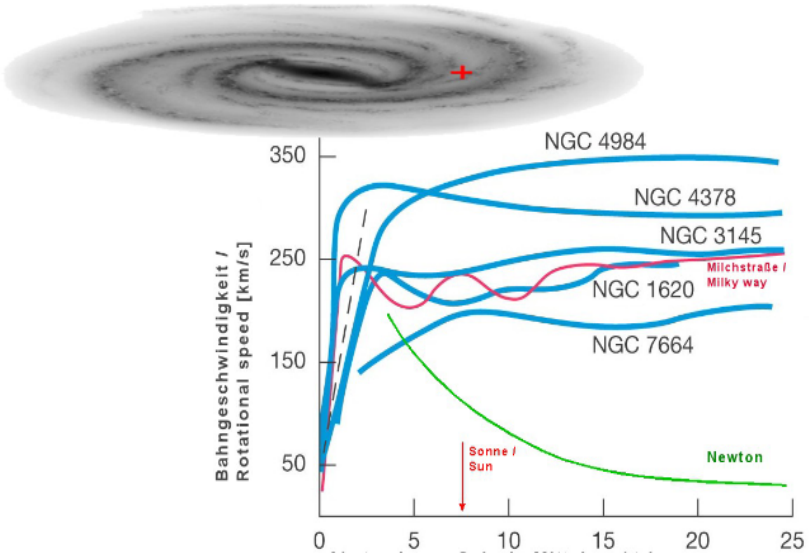


Fig. 4: Angular speed of galaxies - Reference: Folz & Eckardt https://www.atomicprecision.com/Numerical/Paper238b-de.pdf

But this error can be easily cleared up if we understand gravitation as a residual electric charge of atomic dipoles - like Fabrizio Mossotti did - and the Coulomb force as a free surface charge of dynamic masses. First we have to put Newton's law in cylindrical coordinates. Then we move the large mass *M* according to its inertia to the origin (z = 0 ; r = 0) and *m* orbits at a distance $\vec{r}$ around *M*. Then in this coordinate system an attractive force directed towards the center is negative and a repulsive force is positive. We must therefore write Newton's law as a two-dimensional relation:

$$\vec{F}_r \propto -\frac{M \cdot m}{r^2}\vec{e}_r \qquad (4)$$

where $\vec{e}_r$ is the unit radius vector since it is a vector equation.

Also, in our further discussion, for the sake of simplicity, we will replace all constants with the proportional sign.

It should also be noted that Newton's law represents an idealization of the true conditions. Since the radius of the sun is very small compared to the distances between the planets *(radius of the sun to distance between earth and sun: 0.46%)*, both masses can be understood as point masses, with all masses being thought of as being concentrated in the center of gravity.
However, this prerequisite can no longer apply to a galaxy. Its mass is distributed over a disk like a magnetic fluid, with the test mass hanging from the edge. Such a liquid rotates like a solid, as Leonhard Euler[8]) in 1755 already discovered. So we imagine breaking down the total mass M in Newton's equation into smaller and smaller components distributed over a disc-shaped volume. The more the mass is divided, the more the surface area to volume ratio shifts in favor of the surface area. The result is that the free surface charges prevail over the bound gravitational charges. This

8 Histoire de l´Acad de Sciences de Berlin An 1755 p.292

division is continued until the space between the mass M and the sample mass m is evenly filled with smaller and smaller spheres. M is then distributed over a cylindrical disk of radius r and thickness d, and the distribution density of the mass and surface charge, respectively, determines what happens. We get a solid vortex with a fixed structure.

Hence the charge density ρ_Q is proportional to ρ_M. If the test charge m_Q then sits on the edge of the disk V, its distance from the center is also r. We put the obtained expression for M in relation (1) and get

$$|F| \propto 2\pi \cdot d \cdot \rho_Q(r) \cdot m_Q \tag{5}$$

Since the force is the product of mass and acceleration, the radial acceleration is then proportional to the radial density distribution and the radial force is zero since it cancels with centrifugal force. Consequently, the acceleration must also be zero, but this does not have to be the case for all of its components.

$$b = \frac{\partial v_r}{\partial t} + \frac{\partial v_\theta}{\partial t} + \frac{\partial v_z}{\partial t} \propto d \cdot \rho_Q(r) \tag{6}$$

By integration after the time t follows for the speed:

$$v_r + v_\theta + v_z \propto d \cdot \rho_Q(r) \tag{7}$$

Since the radial velocity towards the center is very low in this simple galaxy model, the angular velocity at one point in the galaxy will be proportional to the average charge density and thus also proportional to the mass density of the galaxy, which explains the plateau in Fig.4 using simple mathematics. The angular velocity v_θ suddenly decreases sharply towards the center and the velocity in the z-direction increases sharply, since there is no reason for the matter to compress. From this it can be concluded that no gravitational monster is hidden in the center of the galaxy, but that matter must flow out of the center, which explains the observed plasma jet from the center of M87.

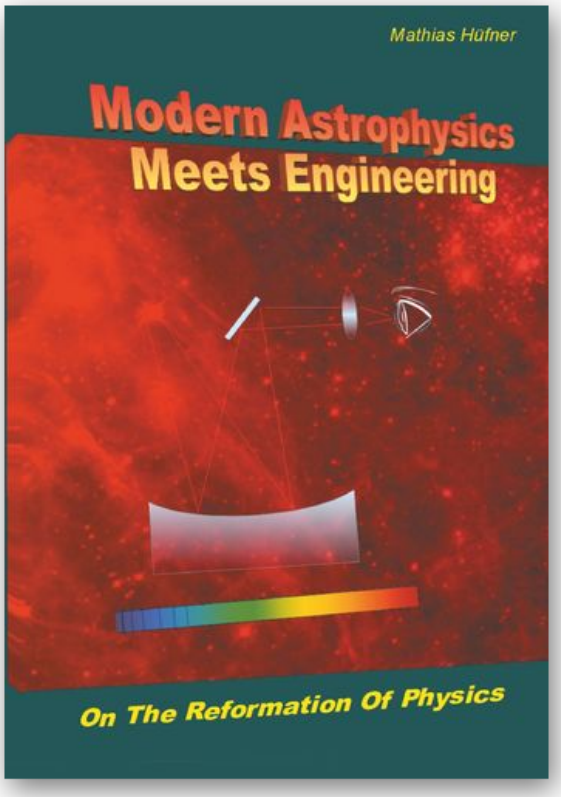
While the image on the left in Fig.1 is a radio image with a decrease in radiation towards the center caused by the limitation of the detector's measuring range (radio telescopes are blind to shorter wavelengths), the radiation in the image on the right is very strong in the optical region of the center and it clearly shows the coiled jet of plasma emerging from the center. Nothing can be seen of a black hole in the sense of Hawking's theory, which he defended against Susskind for so many years like the latter described in his book *The Black Hole War*[9]*)* and which Hawking's disciples still valiantly defend in this days. Taking into account not only purely mechanical but also electrodynamic properties of masses Fig.1 impressively falsifies the mass-less theory of relativity as a physical theory for people of normal ability. A better explanation for the ring structure of M87's radio waves is electrified cosmic dust between this galaxy's inner stars.

In his will, Alfred Nobel stipulated that a foundation should be set up with his fortune, the interest from which would be "*awarded as a prize to those who have rendered the greatest benefit to mankind in the past year.*"
The question then remains: How should we benefit from the Physics Prize 2020? -

Trust no modern Physics?

9 L. Susskind – *The Black Hole War: My Battle with Stephen Hawking to Make the World Safe for Quantum Mechanics* https://www.amazon.de/Black-Hole-War-Stephen-Mechanics-ebook/dp/B00FOR2J76 *or* https://booksvooks.com/the-black-hole-war-my-battle-with-stephen-hawking-to-make-the-world-safe-for-quantum-mechanics-pdf.html

The author's books



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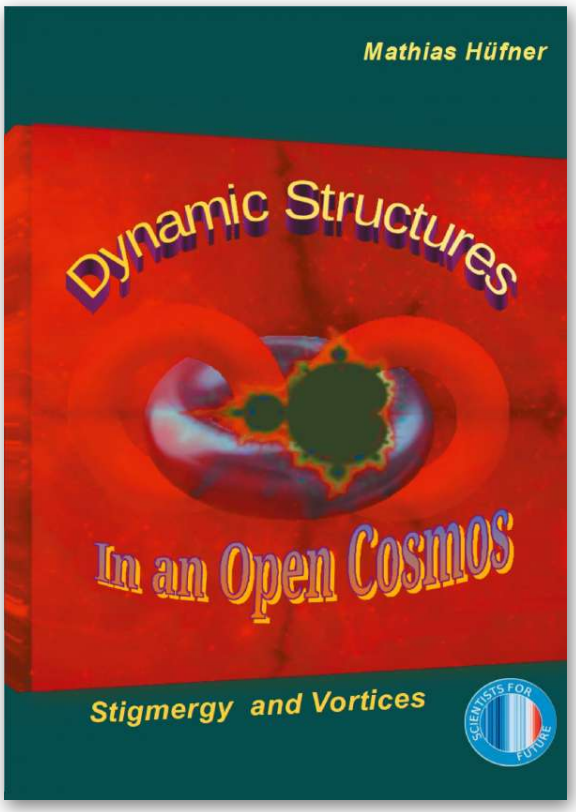

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